



**University
of Victoria**

Graduate Studies

Notice of the Final Oral Examination
for the Degree of Master of Science

of

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BSc (University of Winnipeg, 2013)

**“An Investigation of Microstructural White Matter Changes in Alzheimer’s
Disease and Healthy Aging Using Diffusion Tensor Imaging”**

Department of Psychology

Wednesday, June 15, 2016

9:00AM

Cornett Building

Room A228

Supervisory Committee:

Dr. Jodie Gawryluk, Department of Psychology, University of Victoria (Supervisor)

Dr. Mauricio Garcia-Barrera, Department of Psychology, UVic (Member)

External Examiner:

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Dr. Peter Cook, Department of History, UVic

Abstract

Background: Given that brain pathology precedes clinical symptoms in Alzheimer's disease (AD), identifying pre-symptomatic biomarkers is critical in order to implement symptom-delaying treatments as early as possible. Magnetic resonance imaging (MRI) is an ideal method for detecting early brain changes in Alzheimer's disease, as it is non-invasive, easily repeatable, and widely available. To date, MRI biomarker research has largely focused on loss in grey matter, but there is a lack of research on white matter changes and its relationship with cognitive performance. Diffusion tensor imaging (DTI) is a MRI-based technique that is particularly sensitive to microstructural white matter characteristics, making it an ideal method to study white matter changes. **Methods:** Longitudinal DTI and clinical data from the Alzheimer's Disease Neuroimaging Initiative 2 database were used to examine the 1) within-group microstructural white matter changes in individuals with AD and healthy aging controls at baseline and year one; 2) the between-group microstructural differences in individuals with AD and controls at both time points; and 3) the relationship between white matter changes and cognitive performance at both time points. **Results:** 1) Within-group: Tract-based Spatial Statistics reveal that individuals with AD have reduced fractional anisotropy (FA) and increased mean diffusivity (MD) in the corpus callosum; internal and external capsule; corona radiata; posterior thalamic radiations; superior and inferior longitudinal fasciculus and fronto-occipital fasciculus; cingulate gyri; fornix; uncinate fasciculus; tapetum; medial lemniscus; cerebellar and cerebral peduncle; and hippocampal cingulae at year one compared to baseline. Controls also had reduced FA and increased MD at year one compared to baseline, but such changes were less widespread. 2) Between-group: Relative to controls, individuals with AD had reduced FA and increased MD in the corpus callosum, internal and external capsule; corona radiata; posterior thalamic radiation; superior and inferior longitudinal fasciculus and fronto-occipital fasciculus; cingulate gyri; fornix; uncinate fasciculus; tapetum and hippocampal cingulum. 3) There was a positive relationship between FA and performance on memory tests in individuals with AD. **Conclusion:** The results revealed that DTI holds potential as an AD biomarker given its sensitivity to detect microstructural white matter changes. Longitudinal tracking of brain imaging and AD clinical signs are necessary to further evaluate potential clinical utility.